MATHS

BOOKS - HT Olympiad Previous Year Paper

IMO QUESTION PAPER 2018 SET A

Mathematical Reasoning

1. Simplify : $\dfrac{\sin^3 \theta + \cos^3 \theta}{\sin \theta + \cos \theta} + \sin \theta \cos \theta$
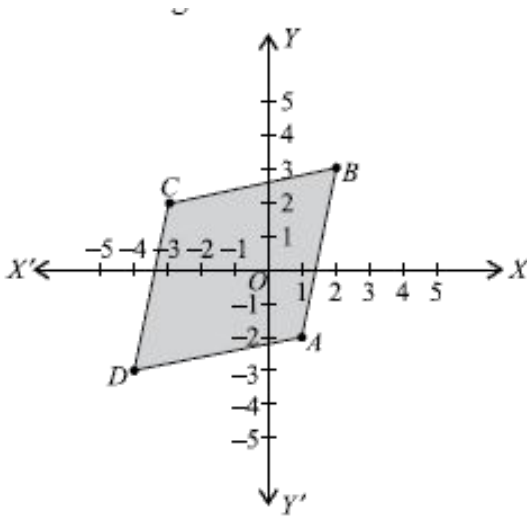
A. 0

B. 1

C. $\sin^2 \theta - \cos^2 \theta$

D. $\sin \theta - \cos \theta$

Answer: B

2. Study the given co-ordinate system carefully and find the area of the figure ABCD.
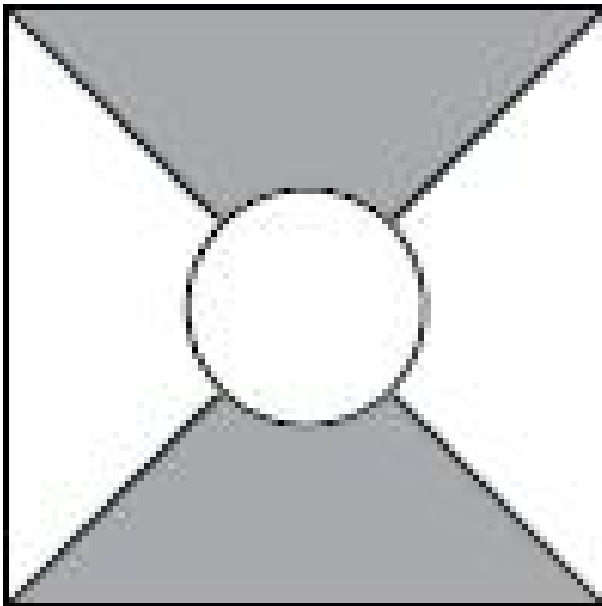

A. 24 sq. units

B. $12\sqrt{6}$ sq. units

C. 18 sq. units

D. None of these

Answer: A

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3. A square lawn has a circular pond in the centre. Find the area of the shaded region, given that the diameter of the circle is 1/3 times the diagonal of square with side 3 cm.

A. $\dfrac{9 - \pi}{2} cm^2$

B. $\dfrac{(18 - \pi)}{4} cm^2$

C. $\dfrac{(18 - \pi)}{18} cm^2$

D. $\dfrac{(2 + \pi)}{8} cm^2$

Answer: B

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4. If the roots of the equation

$\left(a^2 + b^2\right)x^2 - 2(ac + bd)x + \left(c^2 + d^2\right) = 0$ are equal prove

that $\dfrac{a}{b} = \dfrac{c}{d}$

    A. ab = cd

    B. $\dfrac{a}{d} = \dfrac{b}{c}$

C. ad = bc

D. None of these

Answer: C

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5. The ratio of the outer and the inner perimeter of a circular path is 23 : 22. If the path is 5 metres wide, the diameter of the inner circle is :

A. 55 m

B. 110 m

C. 220 m

D. 230 m

Answer: C

6. Find the largest possible positive integer that divides, 125, 162 and 259 leaving remainder 5, 6 and 7 respectively.

A. 6

B. 8

C. 12

D. 13

Answer: C

7. If the polynomial $8x^4 + 14x^3 - 2x^2 + px + q$ is exactly divisible by $4x^2 + 3x - 2$, then the values of p and q respectively are

    A. 2 and 0

    B. -7 and 2

    C. 5 and - 3

    D. 4 and - 1

Answer: B

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8. Following table shows the marks scored by a group of 90 students in a Mathematics test of 100 marks.

Marks	Number of students
0-20	7
20-30	10
30-40	10
40-50	20
50-60	20
60-70	15
70-100	8

Find the probability that a student obtained

(i) Less than 60% marks.

(ii) 70 or more marks.

A.
(i)	(ii)
4/5	4/45

B.
(i)	(ii)
19/45	4/45

C.
(i)	(ii)
37/90	23/90

D.
(i)	(ii)
67/90	4/45

Answer: D

9. A real number $\dfrac{2^2 \times 3^2 \times 7^2}{2^2 \times 5^2 \times 3^2 \times 7^4}$ will have _____

A. Terminating decimal expansion

B. Non-terminating decimal expansion

C. Repeating decimal expansion

D. Both B and C

Answer: D

10. Which of the following options is INCORRECT?

A. The number of terms in the A.P, 3, 6, 9, 12,..., 111 is 37.

B. If the first three terms of an A.P. are x-1, x + 1 and 2x + 3,

then the value of x is 0.

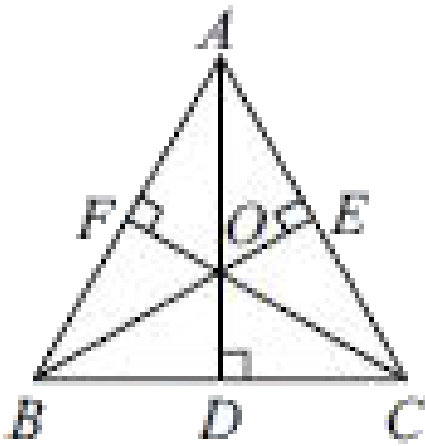C. The sum of first 'n' natural numbers is $\left[\dfrac{n(n+1)}{2}\right]^2$

D. None of these

Answer: C

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11. In the given figure.

$AD \perp BC, BE \perp AC, CF \perp AB,$ then $AF^2 + BD^2 + CE^2$

A. $OA^2 + OB^2 + OC^2$

B. $OD^2 + OE^2 + OF^2$

C. $AB^2 + BC^2 + AC^2$

D. $AE^2 + BF^2 + CD^2$

Answer: D

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12.

$$\frac{1}{2(x+2y)} + \frac{5}{3(3x-2y)} = \frac{-3}{2}$$

$$\frac{5}{4(x+2y)} - \frac{3}{5(3x-2y)} = \frac{61}{60}$$

A. $x = \dfrac{2}{3}, y = \dfrac{1}{3}$

B. $x = \dfrac{1}{2}, y = \dfrac{5}{4}$

C. $x = \dfrac{5}{4}, y = \dfrac{1}{2}$

D. $x = \dfrac{1}{3}, y = \dfrac{2}{3}$

Answer: B

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13. Divide 56 into four parts which are in A.P. such that the ratio of product of extremes to the product of means is $5:6$.

A. 8, 12, 16, 20

B. 10, 14, 18, 22

C. 12, 16, 18, 20

D. None of these

Answer: A

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14. Show that: $\dfrac{\left(a + \frac{1}{b}\right)^m x \left(a - \frac{1}{b}\right)^n}{\left(b + \frac{1}{a}\right)^m x \left(b - \frac{1}{a}\right)^n} = \left(\dfrac{a}{b}\right)^{m+n}$

A. $\left(\dfrac{a}{b}\right)^{m-n}$

B. $\left(\dfrac{a}{b}\right)^{m+n}$
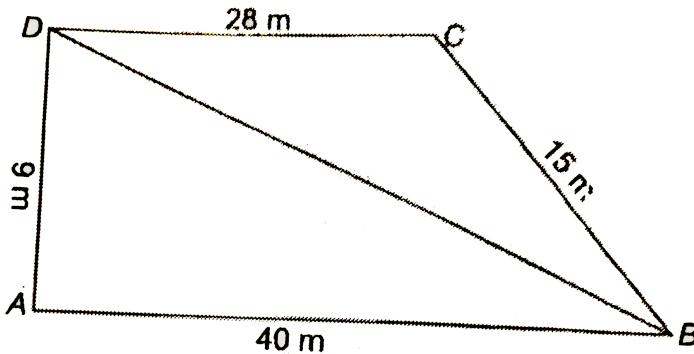
C. $\left(\dfrac{b}{a}\right)^{m/n}$

D. $\left(\dfrac{b}{a}\right)^{mn}$

Answer: B

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15. Figure , $ABCD$ is a field in the form of a quadrilateral whose sides are indicated in the figure. If $\triangle DAB = 90°$, find the area of the field.

A. $298m^2$

B. $186m^2$

C. $306m^2$

D. $195m^2$

Answer: C

16. Study the statements given below and decide which of the statements is/ are necessary to answer the given question?

What is the capacity of the cylindrical tank?

I. The area of the base is 61600 sq. cm.

II. The height of the tank is 1.5 times the radius.

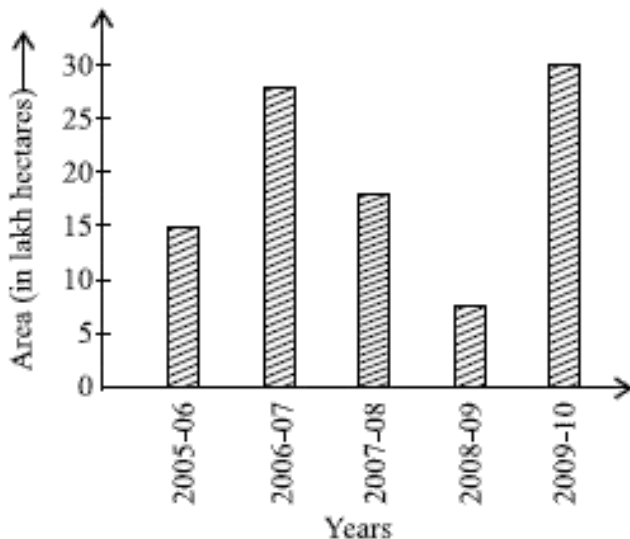III. The circumference of base is 880 cm.

A. Only I and II

B. Only II and III

C. Only I and III

D. Only II and either I or III

Answer: D

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17. The given bar graph shows the area under the rice crop during different years in India. Study the graph carefully and answer the following questions.

What is the average area (in hectares) under the rice crop during the years 2005-2008?
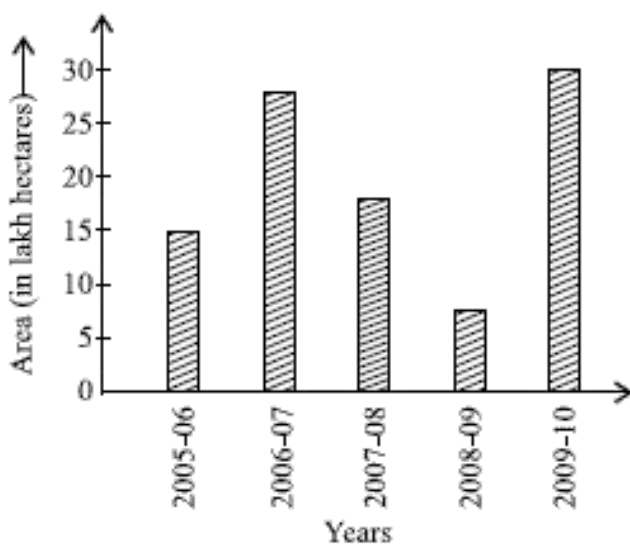
A. 2000000

B. 2500000

C. 4500000

D. 3000000

Answer: A

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18. The given bar graph shows the area under the rice crop during different years in India. Study the graph carefully and answer the following questions.

Find the difference between the area under the rice crop during 2006-2008 and 2008-2010.

A. 375000

B. 450000

C. 750000

D. 75000

Answer: C

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19. If $A + B = 90^0$, prove that

$$\sqrt{\frac{\tan A \tan B + \tan A \cot B}{\sin A \sec B} - \frac{\sin^2 B}{\cos^2 A}} = \tan A$$
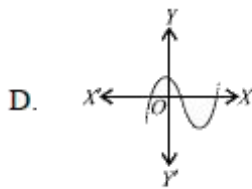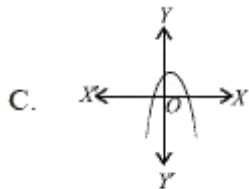
A. tan A

B. cot A

C. $\sec^2 A$
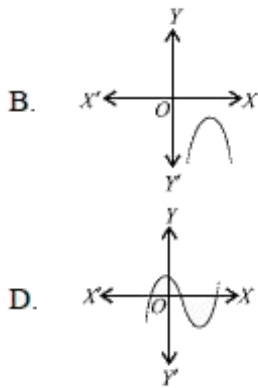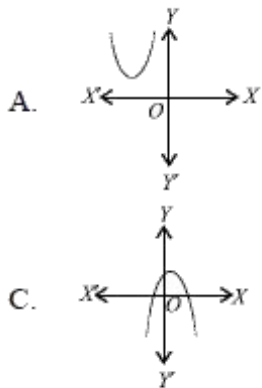
D. $\cos ec^2 A$

Answer: A

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20. Which of the following is not the graph of a quadratic polynomial?

A.

B.

C.

D.

Everyday Mathematics

1. 5 cans of lemon drink and 7 packets of litchi juice cost Rs. 50 while 7 cans of lemon drink and 5 packets of litchi juice cost Rs. 46. Calculate the cost of one can of lemon drink.

    A. Rs. 8

    B. Rs. 12

C. Rs. 3

D. Rs. 5

Answer: C

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2. In a marriage ceremony of her daughter Poonam, Ashok has to make arrangements for the accommodation of 150 persons. For this purpose, he plans to build a conical tent in such a way that each person has 4 sq. metres of the space on ground and 20 cubic metres of air to breath. What should be the height of the conical tent?

A. 20 m

B. 15 m

C. 12 m

D. 30 m

Answer: B

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3. A person had Rs. 21900. He lent a part of it at 5% and the remaining at $1\frac{2}{3}$ % simple interest for one year. If the total interest (annually) was Rs. 584, find the sum lent at 5%.

A. Rs. 15330

B. Rs. 6750

C. Rs. 6570

D. Rs. 13530

Answer: C

4. Two stations A and. B are 110 km apart on a straight line. One train starts from A at 7 a.m. and travels towards B at 20 kmph. Another train starts from B at 8 a.m. and travels towards A at a speed of 25 kmph. At what time will they meet? 9 $a\dot{m}$. b. 10 $a\dot{m}$. c. 10. 30 $a\dot{m}$. d. 11 $a\dot{m}$.

A. $9:00a.m.$

B. $10:30a.m.$

C. $10:00a.m.$

D. $11:00a.m.$

Answer: C

5. Anurag's annual income is Rs. 636000. He spends 22% of his monthly income on paying bills, 18% on household items, 12% on paying his children's fee and 4% he donates to a charity. If two-fifth of the remaining amount he invests in mutual funds, then what is the amount left with him every month?

    A. Rs. 17850

    B. Rs. 12162

    C. Rs. 9328

    D. Rs. 13992

Answer: D

6. Puneet decides to attend some urgent meeting on a particular day in the month of December 20XX. If 1st December 20XX falls on Saturday, then what is the probability that the day chosen by him to attend the meeting is a Saturday?

A. $\dfrac{2}{15}$

B. $\dfrac{1}{6}$

C. $\dfrac{1}{10}$

D. None of these

Answer: D

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7. Marbles of diameter 1.4 cm are dropped into a cylindrical beaker containing some water and are fully submerged. The diameter of the beaker is 7 cm. Find how many marbles have been dropped in it if the water rises by 5.6 cm.

A. 350

B. 250

C. 200

D. 150

Answer: D

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8. A man arranges to pay off a debt of ₹ 36000 by, 40 annual instalments which form an AP. When 30 of the instalments are

paid, he dies,we leaving one-third of the debt unpaid. Find the value of first instament.

A. Rs. 35

B. Rs. 50

C. Rs. 65

D. None of these

Answer: C

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9. A leak in the bottom of a tank can empty the full tank in 6 hours. An inlet pipe fills water at the rate of 4 litres a minute. When the tank is full, the inlet is opened and due to the leak the tank is empty in 8 hours. Find the capacity of the tank.

A. 5260 litres

B. 5760 litres

C. 5846 litres

D. 6970 litres

Answer: B

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10. In 2012, the arithmetic mean of the annual incomes of Jack

and Jill was $3800. The arithmetic mean of the annual incomes

of Jill and Jess was $4800, and the arithmetic mean of the

annual incomes of Jess and Jack was $5800. What of the

incomes of the three?

A. Rs. 4800

B. Rs. 5600

C. Rs. 4200

D. Rs. 5000

Answer: A

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Achievers Section

1. Read the statements carefully and state 'T' for true and 'F' for false.

(P) The point $\left(\dfrac{7}{4}, \dfrac{7}{8}\right)$ divides the line segment joining the points (4, -1) and (-2, 4) internally in the ratio 3:5.

(Q) The point (5,0) on y-axis is equidistant from (-1, 2) and (3,

4).

(R) The points (8, 1), (3,-4) and (2,-5) are collinear.

(S) The centroid of the triangle whose vertices are (1.4), (-1,-1) and (3,-2) is $\left(1, \dfrac{1}{3}\right)$

	(P)	(Q)	(R)	(S)
A.	F	F	F	T
B.	T	T	F	F
C.	T	F	T	T
D.	T	T	T	T

Answer: C

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2. Match the division of polynomials given in Column-I with their respective remainders given in Column - II and select the

correct option.

Column - I		Column - II	
(i)	$\dfrac{3x^2 - x^3 - 3x + 5}{x - 1 - x^2}$	(p)	3
(ii)	$\dfrac{x^3 + 2x^2 - 9x + 1}{x + 4}$	(q)	0
(iii)	$\dfrac{x^4 - 6x^3 + 16x^2 - 25x + 10}{x^2 - 2x + 5}$	(r)	5
(iv)	$\dfrac{x^3 + 8x^2 + 21x + 18}{x^2 + 6x + 9}$	(s)	x - 5

A. $(i) \rightarrow (q), (ii) \rightarrow (p), (iii) \rightarrow (r), (iv) \rightarrow (s)$

B. $(i) \rightarrow (p), (ii) \rightarrow (r), (iii) \rightarrow (s), (iv) \rightarrow (q)$

C. $(i) \rightarrow (r), (ii) \rightarrow (p), (iii) \rightarrow (r), (iv) \rightarrow (s)$

D. $(i) \rightarrow (r), (ii) \rightarrow (q), (iii) \rightarrow (p), (iv) \rightarrow (s)$

Answer: C

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3. Read the statements carefully and select the correct option

Statement - I : The graphical representation of $2x + y = 6$ and

$2x - y - 2 = 0$ will be a pair of parallel lines

Statements - II : When $k = -1$ then linear equations $5x + ky = 4$

and $15x + 3y = 12$ have infinitely many solutions

    A. Both Statement-I and Statement-II are true.

    B. Statement-I is true but Statement-II is false.

    C. Statement-I is false but Statement-II is true

    D. Both Statement-I and Statement-II are false

Answer: D

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4. The given figure (not drawn to scale) shows a running track surrounding a grassed enclosure PQRSTU. The enclosure consists of rectangle PQST with two semicircular ends.
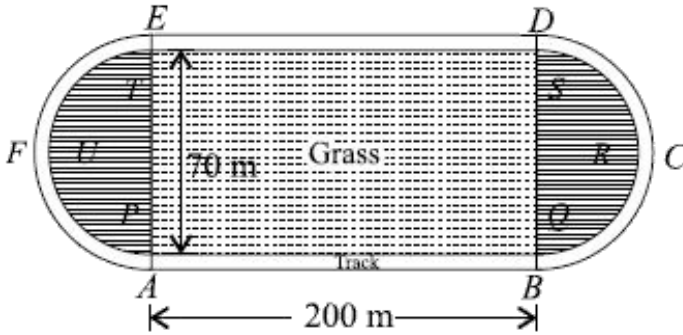
(i) Calculate the area of the grassed enclosure.

(ii) Given that the track is of constant width 7 m, calculate the outer perimeter ABCDEF of the track.

[Take $\pi = \dfrac{22}{7}$]

A.
(i)	(ii)
$17850m^2$	$532m$

B.
(i)	(ii)
$17850m^2$	$664m$

C.
(i)	(ii)
$12320m^2$	$532m$

D. None of these

Answer: B

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5. Fill in the blanks (ii) Area of an equilateral triangle described on the side of a square is (Q) the area of equilateral triangle described on its diagonal

(iii) The altitude of an equilateral triangle with side 'a' equals (R)

A.
(P)	(Q)	(R)
$16:81$	Twice	$\frac{a}{2}$

B.
(P)	(Q)	(R)
$4:9$	Half	$2a$

C.
(P)	(Q)	(R)
$16:81$	Half	$\frac{\sqrt{3}a}{2}$

	(P)	(Q)	(R)
D.	$4:9$	Twice	$\dfrac{\sqrt{3}a}{2}$

Answer: C

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